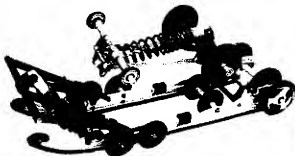


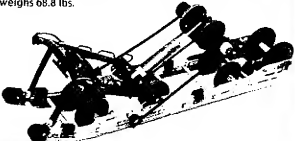
EXHIBIT A

PART I: ORIGIN & NOMENCLATURE





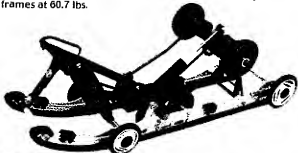
YAMAHA PRO ACTION PLUS used in 2003 Yamahas including the new RX-1 features the only 3-point chassis mount in current use. Fitted with a coupler called the Full-Range Adjuster and a shock angle adjustment, the same basic layout is model specific with shock and spring calibration, the Viper version weighs 68.8 lbs.



FASTACK FIRECAT used only in two Firecat models in 2003 is a narrowed version of what Arctic Cat has built for many years with the addition of a front-rear coupler and the deletion of the familiar torque link mount on the rear arm. This smaller frame is AC's lightest trail frame at 57.6 lbs.



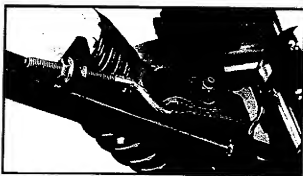
SKI-DOO used in most performance Ski-Doo models in 2003 features a variety of calibrations based on model and package, largely spring and shock choices. A scissors-stop type coupler is used and the rear arm shock angle can be altered to tune shock piston acceleration rates. One of the lighter trail frames at 60.7 lbs.



SKI-DOO AIRCOOLED appears in several Ski-Doo air-cooled models. This skidframe, used in various forms since the middle 90s, is aimed at simplicity and lightweight operation with primarily preload and limit strap adjustment available. This is the lightest skidframe built by Ski-Doo and the lightest trail skid in this review at 56 lbs even.

In 1975, when the first skidframe in a direct line to what we use today appeared it displayed two trailing arms as signature components. The front trailing arm, of course, was conceived as the forward connecting point for the moving platform and the rear arm was to be the connecting point for the rear of the platform.

But something more startling and pivotal happened when this concept was put to the test in the dynamic world of snowmobiling. The



One of the earliest suspension adjustments, the limit strap control front arm movement and determines the amount of vehicle weight carried on the skis. This bolt adjust is used on Yamaha's Pro Action Plus.

torque effect of engine power working through the track created a throttle sensitive weight shift factor on the front trailing arm that gave the snowmobile something it never had before: Balance.

It wasn't long before there were several variations on this theme from the many makers of the time and, before the 80s could begin, the skidframe concept had completely taken over in the sport. There were several reasons for this rise to dominance including better suspension function (i.e. more travel, lighter weight, reduced complexity and longer life. But it was the original "torque arm" effect that remained the most compelling - the ability of the twin trailing arm skidframe to provide the dynamic weight shift balance point necessary to make a snowmobile agile.

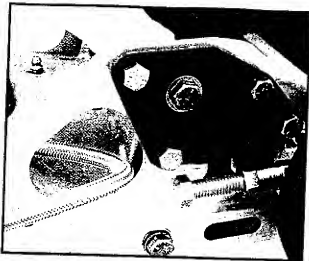
Looking at the current skidframes reviewed on these pages, it's easy to spot the several commonalities all these designs share in 2003.

All accomplish their core function utilizing two trailing arms fastened at one or another place between the tunnel and the suspension rail that provide the contact pressure where the track meets the snow. All feature a combination shock and spring assembly to control the action of each of these arms and all feature one or another combination of wheels to modify the track pressure on the rail and guide the track on its oblong path around the inside of the tunnel.

Other commonalities include the use of high-molecular polyethylene (hi-fax) as an anti-friction medium where the track contacts on the rail and a maximum movement detent on the front arm called the limit strap made of rubber or metal. Some system of setting the load value on the torsion or coil springs is also found on all these skids.



The time-honored cam-style spring adjustment for ride height found on all skidframes since the 1970s. Some makers use cams on coilover shocks to achieve the same adjustment effect.



Introduced in the early 90s, the coupler links the action of the front and rear arms to allow more accurate calibration and more travel control. This is the original design seen on the M-10 in 1993.

Add up these common elements and the sum is basically the skid (same as we knew it during the 80s and most of the 90s). A rider had the adjustabilities of spring preload (ride height) and limit strap length (ski pressure) to adjust and that was about it.

During that nearly two decades, one design puzzle remained unsolved. The front and rear arms continued to operate more or less

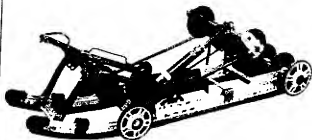
independently of each other from the first designs forward. The free moving front arm was deemed necessary to preserve the all-important weight shift and balance function, but this free movement came with a cost in terms of ride quality. Snowmobile engineers constantly struggled with trying to balance spring and shock values in a system where sometimes one or the other arm would be engaged, sometimes both.

The situation was exacerbated by the trend toward

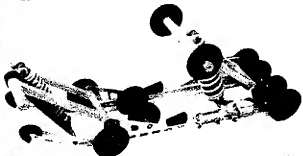
increasing travel that dominated the 90s but a solution appeared in 1993 that has since become a ubiquitous element in snowmobile skidframe design. The aftermarket M-10 skidframe introduced a system to connect the function of the two arms - called a coupler - and this concept has since has a benchmark for the prototype skidframe and nearly all sus-

The other major coupler design utilizes movement stops on the rear arm scissors.

The moment of coupling is controlled by adjustable cams on the scissors or the stops.



FASTACK 22 AC's most familiar and respected suspension has seen many detail changes to arm lengths, mounting points and coupler design and this season features an adjustable 2-way rear coupler for the first time. Also used with varying shock detail and wheel counts in the ZL series where it weighs 60.6 lbs.



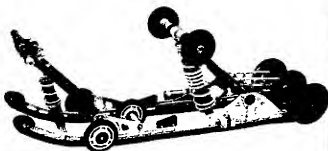
M-10 designed by FAST, Inc. in the early 90s introduced the coupler concept along with the shock angle adjuster and a true 10+ inches of vertical travel. Used in all Blades and in several Polaris models, the M-10 has both critics and devotees but no one denies its pioneer status and light weight at 57.8 lbs.



FASTACK 22 used on a variety of AC two passenger models since its introduction in 1993. Is essentially a trail FastTrack with the addition of a fiberglass overload spring which can be flipped into action for the added weight of two riders. The added mechanism makes the 2-up weigh 68.5 lbs.



SUMMIT 22 is the skid used in Ski-Doo based on SC-10 geometry but, like most skids in use in 2003, sans the coupler mechanism. Known for controlled weight, Summit weighs in at 62.7 lbs.



M-10 is the newest skidframe from Blade introduced for 2003 with a unique "live axle" design that manages track tension for the suspension's 16 inches of travel. The coupler moves up to the top of the rear arm mount in this design and the axle link provides a track tension G-bump control while remaining relatively light at 58.2 lbs.



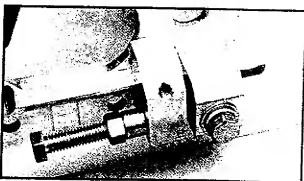
SC-10 II Airshock is used in select Ski-Doo Touring models in 2003 to introduce automatic load leveling to snowmobiling. Sensing the weight of the passenger load, the airshock maintains ride height to deliver consistent ride quality for one or two riders. Tips the scales at 70.9 lbs.



ARCTIC CAT M1 recently revised for use on the M1 mountain series from Arctic Cat, the mountain version maintains some coupling effect while it substitutes some materials to keep the skid as light as possible while revised mountings emphasize flotation. The lightest mountain skid in this review at 56 lbs even.



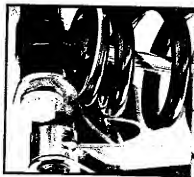
RMX 44 used in Polaris mountain models appears with no coupler like most mountain skids and features a relatively large reservoir Ryde FX rear shock. An evolutionary design known for good flotation and durability, the RMX skidframe weighs 58.4 lbs.



The angle of the shock in relation to the skidframe's movement determines the acceleration rate and speed of the shock piston. This characteristic is altered by the FRA adjustment on the M-10.

persions pictured here display this feature in one form or another. The coupler allows the front arm torque effect to continue, mostly unaffected while it links the two trailing arms for dealing with the ride and comfort issues.

With the all but universal adoption of the coupler another adjustment was added, that of the coupling moment. This is the point in the suspension travel where the trailing arms cease being independent and are linked together. The exact point where this occurs is a setting available at the coupler location in the varying designs used today.



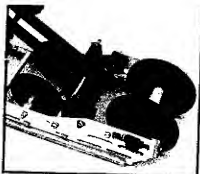
Of all off-road vehicles, the snowmobile presents the greatest challenge to suspension designers for two main reasons. The first comes from the enormous range of conditions presented by the winter environment. Trails can vary from smooth and slippery to chewed-out and filled with craters and moguls. In-between there are stutter bumps, rollers and drifts to attack rider comfort and control. The second reason is - of all off-road vehicles, the snowmobile is the only one that operates without tires. The lack of the pneumatic buffer provided by a tire makes the job of suspending a snowmobile truly monumental.

The shock function can be adjusted with a selection of shock mounting tabs. This method is used by Ski-Doo on the SC-10 II and on Yamaha's Pro Action Plus suspension.

Adjustments to suspension are rarely, if ever discussed by users of 4WD trucks, ATVs and dirt bikes, but adjustability is the first line of defense in snowmobiling and a myriad of detail adjustments have found their way into the sport to satisfy this need.

Not an adjustment, the torque link system for mounting the rear arm traps torque that would otherwise affect track tension on several Arctic Cat FastTrack skids and more recently on the Polaris EDGE and Pro X models.

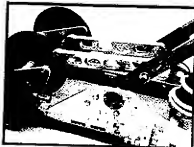




Weight is always a consideration and especially with the part is an "unsprung" moving suspension. Arctic Cat and Polaris have recently moved in the direction of narrower skids to shave mass in their high-performance models. This is the rear of the 13.5 Inch Firecat skidframe.

Skidframes on most touring and performance snowmobiles for the most part all display adjustability to shock and spring values equal in sophistication to any other form of motorsport. Riders today can tune their ride and handling with adjustments - depending on make and model - to shock compression and rebound damping, shock absorber lever ratio, trailing arm attachment points.

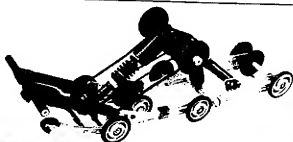
There are also several automatic and from-the-saddle adjustments available that permit the suspension to be tuned on the fly or to tune itself in response to varying trail conditions using hydraulics or electronics.



Accompanying this story are pictures and descriptions of all the distinct skidframes being produced for 2003. Despite the many basic similarities, there is tremendous variation

in detail design and in the way each suspension is tuned and adjusted. These are the assemblies that define the snowmobile as we know it. Knowing and understanding how and why this component works is an important key to better, more enjoyable snowmobiling. ▲

In the next issue of SUPERTRAX, look for Part II of The Adjustables for more about those detail adjustabilities, how to use them and - this is crucial - evaluate the results.



EDGE TUNING Is the latest design from Polaris using essentially an Extra-12 type front arm design mated to an M-10 rear arm design. This suspension is aimed at delivering premium touring ride with the minimum of rider adjustment and comes in as Polaris heaviest for 2003 at 72.8 lbs.

NEW IN 2003 SKIDFRAME FUTURE

The snowmobile track suspension is highly evolved but development continues at the same frantic pace as ever. Be here next issue to see where the art and science of snowmobile ride & handling is headed ... and why.



EDGE suspension is the mainstream design of Polaris five different suspensions offered for 2003. Featuring dual adjustable coupling and a torque link style rear arm mount plus Fox shocks in several applications, this popular skidframe scales a bit portly at 67.4 lbs.



PRO X is a refinement of the coupled EDGE design that widens out the front arm lever, alters several detail geometries and uses the torque link rear arm mount. Usually fitted with reservoir shocks - some models have shock bodies from offroad legend Walker Evans - the Pro X trims down to 63.9 lbs.



M-10 ACE appears in some limited edition Polaris models and is sold for aftermarket installation by FAST, Inc. Essentially an M-10 with a very durable geared shock angle adjuster for on-the-fly suspension adjust from the saddle, the ACE makes the most of the sophisticated tuning on the M-10 while shaving off weight to come in at 64.5 lbs.



FFP FULL RATE SUS COUPLER used in Yamaha mountain models including the new RX-1 maintains a full coupling effect with Yamaha's sliding rod Full Rate Adjuster and features an altered (longer) front arm and revised mount aimed at maximum flotation. The heaviest mountain skid at 74 lbs even in the RX-1.



GETTING THE TO MARKET



(left) Clay models are a visual tool. As designs are finalized, the models can be sculpted to view possible concepts.

(right) CAD software speeds up the development process and tests designs prior to prototype assembly.

We Love Snowmobiles

We own them... we ride them...
and we insure them

We're The Insurance Guys

For over 30 years our family owned agency has
specialized in affordable Snowmobile, ATV,
Motorcycle, Motorhome & Watercraft insurance.

Call The Insurance Guys now
for a free premium quotation

1-877-271-7371

Web Site:

www.theinsuranceguys.org

Email:

miker2@eschelon.com

The Insurance Guys are: IMC Agency, Inc.
3225 W. Hwy. 13, Suite 103, Burnsville, MN 55337

"At event, in November 2001
changed the spirit of the IQ develop-
ment. The World Snowmobile
Association (WSA) and Polaris National
Season-opening snowcross in Duluth,
Minnesota, was the first time the public saw
Ski-Doo's radical new machine. Its new racer
was in the REV chassis.

"We were working on the project long enough to know the REV had a lot of the same things we were working on," Sampson said. "We were disappointed
when the REV was there ahead of us."

Sampson and the other engineers prob-
ably underestimated the impact of the
REV chassis. With it, Ski-Doo stole
Polaris' 12 years of market leadership and
their pride of being No. 1 with it.

Pat Bourgeois, Polaris' marketing communications manager, said Polaris' 900i Liberty engine concept was pitched shortly after CEO and President Tom Tiller took over in 1998. The laydown engine design and how it would fit in a chassis were part of that plan, Bourgeois said.

Though Polaris might have pleased its consumers and dealers if it released the IQ chassis sooner, the Polaris engineers we spoke with were unified when they said they didn't want to release the new product until it was ready and until it met all the required checkpoints of the Polaris Development Process (PDP). The PDP is the quality control measure Polaris uses on everything it builds prior to going to market.

"PDP forces the company to have a long development cycle," Pat Adrian, snow project leader, said. "The really big thing on the IQ was that in the past we've always just taken the chassis we've had and updated a system. [The IQ] was a new chassis, new suspensions and a new engine. We'd never done all three at the same time. When you throw something that big into action, there are a lot of questions to have answered before you get the go-ahead."